GATEWAY SELECTION FOR MOBILE COMMUNICATIONS NETWORK ARCHITECTURE OPTIMIZATION

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to gateway selection for mobile communications network architecture optimization.

[0003] 2. Related Background Art

[0004] The following meanings for the abbreviations used in this specification apply:

- **[0005]** APN access point name
- **[0006]** BS base station
- **[0007]** CAPEX capital expenditure
- **[0008]** CDN content delivery network
- **[0009]** CP control plane
- **[0010]** EPC evolved packet core (in EPS)
- **[0011]** EPS evolved packet system, LTE RAN and EPC
- **[0012]** GPRS general packet radio service
- **[0013]** GTP GPRS tunneling protocol
- **[0014]** GW gateway, S/P-GW
- **[0015]** HW hardware
- **[0016]** IETF internet engineering task force
- **[0017]** IP internet protocol
- **[0018]** NAS non access stratum: signaling between MME and UE
- **[0019]** SGW serving GW
- **[0020]** PGW PDN GW
- **[0021]** LTE long term evolution
- **[0022]** MME mobility management entity
- **[0023]** NW network
- **[0024]** OAM operations, administration and management
- **[0025]** PDN packet data network
- **[0026]** RAN radio access network
- **[0027]** SIPTO selective IP traffic offload
- **[0028]** TEID tunneling endpoint identifier
- **[0029]** UE user equipment, mobile device
- **[0030]** UL, DL uplink, downlink
- **[0031]** UP user plane

[0032] To cope with an ongoing and predicted exponential data traffic growth for mobile networks, optimizations for an EPC network architecture are proposed in different research activities. The following technologies are focused:

[0033] 1. Distribution of Mobility Anchors and Gateway Functions (GWs)

- **[0034]** More direct/optimal routing decreases traffic latency and saves transport costs, in particular for local traffic (cache, CDN, mobile to mobile traffic).

[0035] 2. Centralization of Network Management and Control Functions

- **[0036]** This helps reducing both operational costs and CAPEX of the overall system. According to EPC Rel.8 architecture, control (MME) and user plane (S/PGW) have been split.
- **[0037]** Centralization means less interfaces to operator backend and management systems which results in less managed objects. Centralization is especially needed if the number of other network functions/nodes is increased, like in the case of distributed GWs as mentioned above.
- **[0038]** Centralized controllers can result in higher HW utilization like in cloud computing environments.

[0039] 3. Network Virtualization and Programmable Networks

- **[0040]** This promises cost efficiency of future networks e.g. due to network sharing.
- **[0041]** Open Flow protocol was designed to standardize a further separation of control and user plane functions in transport networks that may allow for further cost savings:
  - **[0042]** Network nodes for routing and switching can become less expensive as they provide only simple standardized functionality.
  - **[0043]** The control plane can be centralized, this in turn allows:
    - **[0044]** less expensive network management for the operator;
    - **[0045]** decision making using information of the whole network view.
- **[0046]** The control plane of the transport network can cooperate/can be combined with mobile network control functions which allows further optimization of resource usage.

[0047] FIG. **1** shows a current EPC network architecture in a simplified manner. S1-C and S11 are CP interfaces between a RAN and an MME and between the MME and GWs, to setup and control user data sessions and GTP tunnels inside the network via an S1-U interface. SGi is an interface between a GW and an IP network, e.g. the Internet, via which user IP packets are communicated. A DNS server is a main support function for selecting a GW by the MME. A DNS query contains an APN used by an UE for data connection and can be enhanced with other information like TAC/eNodeB-ID as location information of the UE. In FIG. **1**, dashed lines show control/signaling traffic, and solid lines show user IP packets traffic.

[0048] To further evolve the EPC, different technologies as mentioned above can be used. This includes centralization of control functions that are currently distributed in GWs, new mobility procedures (e.g. for GW relocation) or the use of OpenFlow to more dynamically change routing in the network.

[0049] With the current architecture this would highly impact the MME as the natural place for centralized mobility management. It would increase the barrier for introducing new and more revolutionary network concepts because an already very complex system would be enhanced with a lot of new functionality.

[0050] Operators may be also concerned about the network stability and require a more clear separation for new and old functionality. This separation would also serve for multi vendor scenarios where the MME and the GW might be provided by different vendors. A challenge for the introduction of such new technologies is to allow a stepwise network update for example in specific regions only. And to avoid the need to upgrade all components of the network, e.g. keep changes limited to the core network and stay compatible with the radio network (eNBs).

[0051] In the recent 3GPP Release specifications, the MME is responsible for GW selection and the establishment of the connection between eNBs and GWs (GTP tunnels).

[0052] With the help of 3GPP Release 10 feature "SIPTO", the MME is able to select GWs depending on UE location in a more distributed way.